and then the variations—less than one-fifth of this mean amplitude—were disregarded in the counting. The mean amplitudes thus obtained show that the lines of equal-pressure amplitude form circles with the South Pole as center.

These pressure amplitudes increase in value from a minimum near the equator, rise to a maximum at 60° S., and then decrease to the South Pole. The amplitude is 4mm. along the parallel of 20° S., 13mm. at 40°, 19mm. at 60° and 16mm. at 70°.

The regions where directions along the parallels of latitude are conspicuously departed from are in South America and South Africa where high land exists. The paths of the equi-amplitude lines over the land surfaces correspond with the directions of the forward movement of the anticyclones over these lands. The increase in amplitude from the equator to about latitude 34° corresponds to the approach of the belt in which the anticyclones move; the maximum along the 60th parallel is due to the cyclonic belt, and the decrease farther south is due to the approach to the South Polar anticyclonic area.

Dr. Lockyer measured the mean daily rate of displacement of the anticyclones and found about 12° in longitude for South Africa, 11°5′ for South Australia, and 1°7′ for South America. Over the southern ocean the daily displacement of the anticyclones is about 9°2′ in longitude. The mean velocity around the earth being approximately 10°7′ per day, the anticyclones complete the circuit in about 33.6 days. A diagram (Pl. XIV) shows the correlation of the cyclones of the cyclonic belt with the anticyclones of the high-pressure area of the temperate region.

Comparing Dr. Lockyer's system of the surface-air circulation with what we know about atmospheric circulation in the northern hemisphere, one is tempted to think that his theory is simply a speculation. However, the daily weather maps of Australia and the experience gained by the antarctic expeditions in the frozen South show, in a most convincing fashion, that Dr. Lockyer's researches and the results he obtained are of a far-reaching practical value.

HENRYK ARCTOWSKI.

MATHEMATICAL GEOGRAPHY AND CARTOGRAPHY

The Effects of Errors in Surveying. By Henry Briggs. xi and 179 pp. Ills., index. C. Griffin & Co., Ltd., London, 1912. 8 x 5½.

This excellent little book, it is stated, is intended to investigate how errors combine in affecting the accuracy of surveys, in order that rules may be framed to help the surveyor to guard against error and methods devised to allow him to assess the error likely to occur in any given case in practice. After the introduction are five chapters headed, respectively, the analysis of error, the best shape of triangles, the propagation of error in traversing, the application of the methods of determining average error in traversing, and the propagation of error in minor triangulation. A final chapter summarizes the conclusions reached. The results of "Least Squares" are assumed, but the mathematical work involved in demonstrating the author's conclusions is given in full. The examples are such as occur in every-day practice with small instruments, rather than in geodetic work, thus making their application more general. The typography is excellent.

JAMES GORDON STEESE.

Lehrbuch der Landesvermessung. Von E. Hegemann. [Part 1]: 261 pp. Part 2: 306 pp. Map, diagrams. P. Parey, Berlin, 1906, 1913. Mk. 12. and Mk. 13. 9 x 6.

An unexplained interval of seven years separates the appearance of Vol. II, Projections, Levels, and Topography, from Vol. I, Triangulation, of this Manual of National Surveys. The treatment is essentially mathematical, about two-thirds of the work consisting of formulæ and their development. Wherever appropriate, illustrative examples from the Prussian Survey are solved in detail.

Chapter 1, Taking the Measurements, occupies half of the first volume. It discusses the field work and methods of a primary triangulation survey. Much of it is of historical interest only, being a description of the methods and instruments employed at different times on the Prussian Survey, rather

than an exposition of the approved practice of the present day. The next six chapters discuss the reduction and adjustment of a triangulation system. There are presented, successively, the spherical trigonometry involved, a discussion of the earth ellipsoid, the solution of an individual triangle, the adjustment of a chain of triangles, discussions of the rectangular and geographical systems of coordinates, and the calculation of the geographical coordinates of a triangulation net. In Chapter 8 is given a summary of the Prussian net, accompanied by a map.

The first seven chapters of the second volume continue the mathematical discussion. There are presented, successively, the geodetic line, the normal form, mathematical formulæ, projection after Gauss, transverse coordinates, the conical projection of the sphere and the spheroid, and the general properties of a geodetic triangle. The remaining two chapters, which occupy less than one third of Vol. II, cover the determination of elevations and the filling in of the topography. JAMES GORDON STEESE.

Astronomy. By George F. Chambers. xxiii and 335 pp. Ills., index. D. Van Nostrand Co., New York, 1914. $1.50. 6½ x 4½.

The sixth work on astronomy by Mr. Chambers, who is, however, a lawyer—astronomy being his avocation. The book is for the many who would not make a serious study of astronomy, however impressed with the splendor of the heavens. This outline of leading facts will greatly assist such readers; and though they may possess only a smattering of scientific knowledge, it will answers many questions, stimulate intelligent interest, and help inquirers to use, with profit and enjoyment, a small telescope or even an opera glass. The volume, though small enough to carry in a coat pocket, is remarkably rich in helpful illustrations, most of which are not in general circulation. Mathematical matters are kept in the background. The work first treats of the scope of astronomical science, and discusses in the succeeding chapters the sun, moon, tides, climates, eclipses, comets, shooting stars, stars, groups of stars and nebulæ, the constellations, telescopes, time and its measurement, the spectroscope, and, in the appendices, statistics relating to planets and their satellites and a catalogue of celestial objects that may easily be studied through small telescopes.

GEOMORPHOLOGY

Principles of Stratigraphy. By A. W. Grabau. xxxii and 1150 pp. Ills., index. A. G. Seiler & Co., New York, 1913. $7.50. 9½ x 6.

Written for professional geologists and technical students, this massive treatise contains a large fund of valuable information, much of which had previously been difficult of access. The labor of collecting this material has evidently required years of painstaking endeavor, and the author himself has made important contributions from his own studies.

The introductory chapter supplies a general view of the facts and theories about the earth's divisions and general conditions, as well as a discussion of the several parts of geologic science. It is followed by seven large sections dealing with the atmosphere, hydrosphere, lithosphere, pyrosphere, centrosphere, biosphere and classification of geologic formations. Nearly half of the book is devoted to the lithosphere, but the hydrosphere and biosphere also receive extended treatment. The eight sections comprise thirty-two chapters, which deal with such topics as "The composition and physical character of the hydrosphere," "Classification of the rocks of the earth's crust," "Structural characters and lithogenesis of the marine hydroclastics," etc. Each chapter contains a description of conditions and sketches of the conclusions reached by the more important students of the respective fields. Most of the chapters on sedimentation include interesting comparisons of ancient and modern sediments, and each closes with a selected bibliography of the subject.

As the headings indicate, a wider field is surveyed than most stratigraphers would probably deem necessary under the caption of the book. The author has apparently thought it best to include a brief discussion of all phases of geology that ought to be a part of the mental equipment of a stratigrapher.